802.11b Wireless Serial Port Adapter
WiSER2400.IP User Guide

www.otcwireless.com

WiSER2400.IP

Wireless Serial Port Adapter
User Guide
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Chapter 1 - INTRODUCTION

WiSER2400.IP is an 802.11b compliant, or WiFi, radio with an RS232 serial interface.

The WiSER2400.IP radio takes serial data from the equipment or computing device connected via its RS232 port, converts the serial data into 802.11-compliant data packets, and transmits these packets with the RF modulation that is compliant with the specifications of the 802.11b physical layer. On the receiving end, the radio demodulates the RF signal, removes the Ethernet (802.11) headers, unpacks the packet and delivers the data byte-by-byte to the destination equipment/device through the RS232 serial port.

Each WiSER2400.IP radio acts as a "Station" and operates in either infrastructure or ad-hoc mode in accordance to the 802.11 standards. As such, this radios enables RS232-interfaced devices to participate in a wireless Ethernet network. In this capacity, the radio, in addition to eliminating the RS232 cables, functions as a media converter for RS232-interfaced equipment and computing-devices.

The radio is fully self-contained in performing the conversion between serial data and wireless-Ethernet packets. That is, no device driver needs to be installed on the hosting equipment or computing device the radio is connected to. True Plug & Play feature therefore is achieved with any equipment or computing devices with an RS232 port. This also means the radio can be used on equipment and /or computing-devices with any Operating Systems. This is particularly useful for instruments/equipment where the use of RS232 interface is utilized. Examples include cash registers, electronic whiteboards and navigation instruments.

WiSER2400 has a compact form-factor that blends easily into an office/ classroom environment. It also lends particularly well to portable applications. The specifications are given on the next page.

The utility program can be used to monitor the communication condition once the radio is in operation. The radio runs self-sufficiently without the aid of any driver program in the host equipment or computer connected to the radio. This utility program therefore is intended to be, in most cases, just a tool for the network operators. The utility is also needed to configure the WiSER2400.IP for both wireless and UDP/IP parameters. The utility program is simple to install and easy to use through its graphic user interface. The details are described in Chapter 3.

Note: The terms WiSER2400 and WiSER2400.IP are used interchangeably through out this document

WiSER2400.IP WiFi Radio

Key Features

❑ Plug & Play operation—
  o No driver on the host device is required for radio operation
  o Radio operation is independent of the operating system on the host equipment or device (Windows 98/NT/2000/ME/XP, Linux, Unix, embedded, etc.), as long as an RS232 port is properly supported
❑ Supports 64-bit and 128-bit encryption for secured communication
❑ Industry standard IEEE 802.11b-compliant wireless interface
❑ 11Mbps data rate and automatic selection of lower data rate (5.5, 2 and 1 Mbps) in degraded RF environment
❑ Integrated omni-directional-antenna to provide best tradeoff between link-quality and mobility
❑ Microsoft-Windows-based configuration utility

Applications

❑ Standard-compliant wireless networking for computers and equipment with an RS232 interface
❑ Embedded devices, tools, instruments, equipment and appliances that can benefit from the re-configurability of wireless link yet are unfriendly to the installation of device-drivers
  o POS equipment for stores where re-configuration is frequent
  o Control/monitor equipment where mobility is required

Specifications

Model	WiSER2400.IP
Standard	802.11 and 802.11b
Host Interface	RS232
Frequency	2.4GHz – 2.495GHz
RF Channels	11 channels (US, Canada), 13 channels (Europe), 14 channels (Japan)
Transmission power	14dBm at antenna input typical
Receiver sensitivity	-80dBm @1e-5 BER typical
Antenna	Integrated dipole antenna with ~2dBi gain
Data Rate	11, 5.5, 2 or 1 Mbps fixed rate, or configured to automatic rate selection
Modulation	CCK, Direct Sequence Spread Spectrum
Link Distance	~1200 ft in open space
Network Types	Support normal station to AP link in the infrastructure mode
Data Encryption	Support the standard 64-bit and the 128-bit WEP
Network Security	MAC-address-based access control
AC adapter	Output: 5V, 1A; Input: 100-120V, 50-60Hz, ~0.3A
Current consumption	<480mA (max. reached in transmit-mode)
LED Indicators	4: Power, Transmission, Receiving, Link
Operating Temperature	-10°C – 50°C
Regulation Compliance	FCC part 15,Class B CE (ETSI EN 300 328-1, ETSI EN 301 489-17) IC (for Ubicom-based model)

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Chapter 2 - INSTALLATION OF WiSER2400.IP

Installation of WiSER2400.IP Hardware

Standard Hardware Items

1 WiSER2400.IP radio
1 3-foot RS232 –P cable
1 ac-dc power adapter
1 pair of Velcro mounting pads

Power

This radio connected to your equipment draws power from the provided AC-DC power adapter that plugs into a wall outlet.

RS232 Connection

The WiSER2400.IP radio is shipped with one RS232 cable. This 3-foot cable is intended for use with any RS232 equipment (whiteboard, instrument, etc.) and has the specification listed below:

> Option –P—terminates in a male DB-9 connector, no dc-power is available from this cable

Connect the modular plug (which resembles an over-sized telephone plug) of the RS232 cable to the modular jack (which resembles an over-sized telephone jack) at the bottom panel of the WiSER2400 radio. Connect the DB-9 (9-pin, can be female or male depending on the equipment) connector of the RS232 cable to the RS232 port in the client equipment or computer.
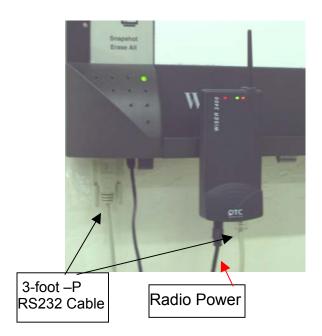
Status LED's

Power on the WiSER2400 Radio, the LED's on the front panel should exhibit the following patterns:
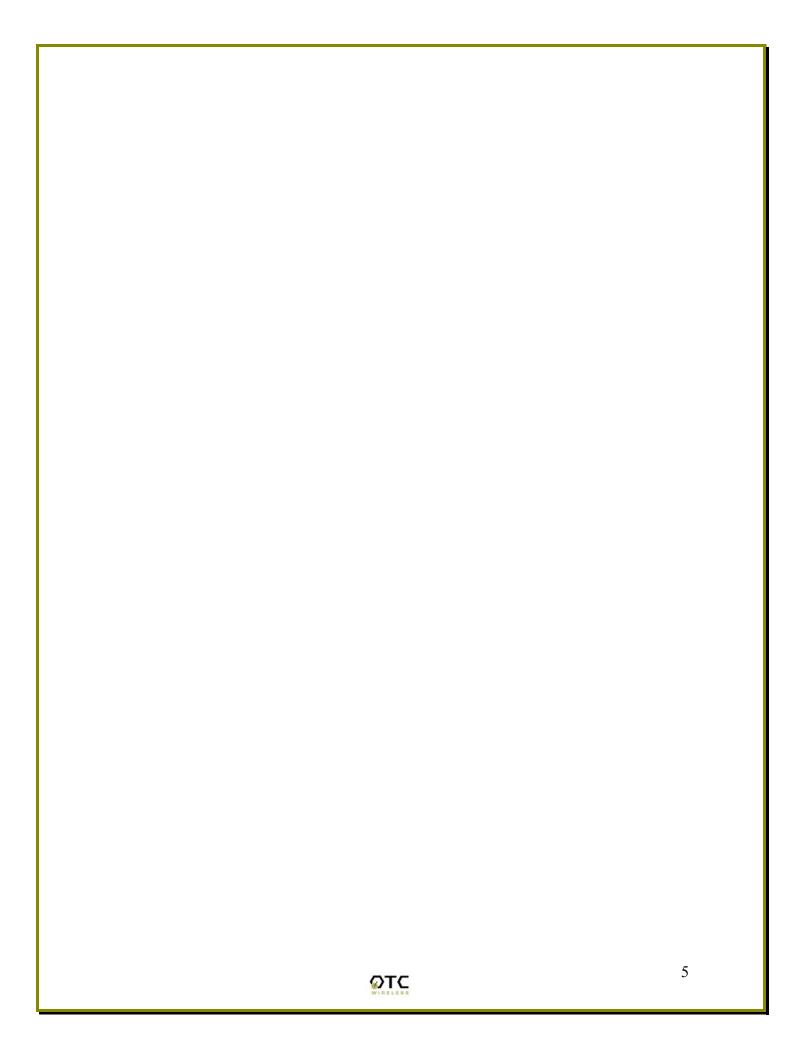
LED	Color	Light Blinking Pattern	Indication
ON	RED	Steady on	Proper power is supplied
RX	GREEN	Steady on	Unit linked to any wireless station
		Steady blink	Unit not linked to any unit
TX	RED	Flickering	Unit transmitting RF signal
LINK	YELLOW	Steady on	*Not in use*

The WiSER2400.IP radio is configured as a client Station and cannot be changed. As a station, one of the most useful diagnostic tools may be the green RX LED: a blinking green RX LED indicates the absence of a useful communication link.

Once the hardware is checked out to work properly with the intended host device or equipment, the radio can be secured in the desire location by the pair of Velcro pads supplied.

An installation example where the WiSER2400.IP is connected to an RS232 equipment (whiteboard)

3-foot –P RS232 Cable

Radio Power

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Installation of WiSER2400.IP Software

System Requirements

For using the WiSER2400.IP Wireless Ethernet Adapter's utilities software, your computer must meet the following minimum requirements:

- ✓ Windows® 95 (OSR2)/ 98 (SE)/NT/ME/2000/XP
- ✓ One COM port (with a DB-9 male connector or an appropriate adapter to connect to a DB-9 female connector)

Installation

To install the utility program, simply insert the CD-ROM provided. Copy the "wue101.exe" file to the desired location on your PC.

Note that to use the WiSER2400.IP properly as intended, you must configure the WiSER2400.IP radio to the appropriate IP [Internet Protocol] configurations as your network.

Note: For the utility program to configure or monitor the WiSER2400 radio through a COM port, there must be no another serial (RS232) program that also accesses or control the same COM port.

Chapter 3 - Diagnostic and Configuration Utility

Overview

This chapter describes the functionalities and operations of *WiSER2400.IP Diagnostic and Configuration Utility* program. The utility program can be used to configure and monitor WiSER2400.IP radios. The WiSER2400.IP utility program is supported on Microsoft Windows® 95(OSR2), 98(SE), NT, Millennium, 2000, and XP. Figure 1 below is WiSER2400.IP utility main window.

Warning*: The utility program may not work simultaneously with another RS232 application program since both programs would compete for the control to the same RS232 serial (COM) port connecting the WiSER2400 radio.*
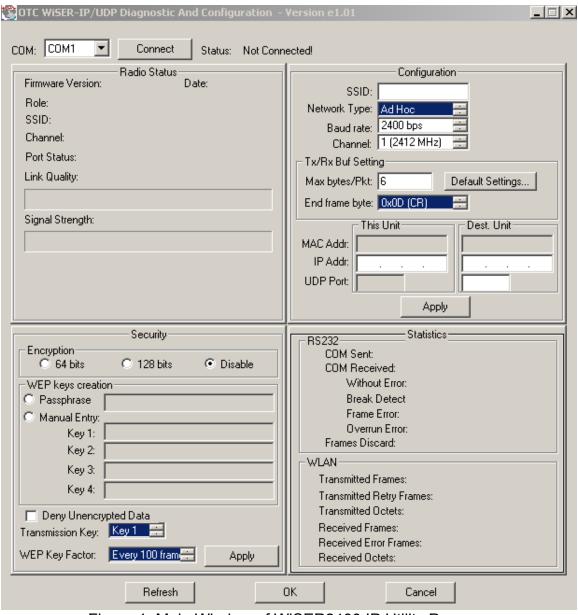
Figure 1. Main Window of WiSER2400.IP Utility Program

In general, the main window consists of five panels: *Connection and Overall Status, Radio Status, Configuration, Security*, and *RS232 and WLAN Statistics*.

Connection and Overall Status Panel

The *Connection and Overall Status* panel, shown in figure 2, controls and maintains the serial connection, and displays up-to-date connection status. It has a pull down menu for choosing COM ports, a **Connect** button, and a text field displaying connection status.

Figure 2. Connection and Overall Status Panel

The pull-down menu allows users to select COM ports (RS232 serial port) so that the utility program knows where to connect to WiSER2400 radio unit. The pull-down menu becomes inactive and inaccessible when the connection between the WiSER2400 radio and the utility program is active.

After appropriate COM port is selected from the pull-down menu, click **Connect** button to have the utility program claim the COM port. If a COM port is successfully claimed by the utility, the **Disconnect** will be displayed on the button instead of **Connect**. Click **Disconnect** button to release the control of the COM port from the utility program.

Note: Other panels in the main window stay inactive unless a COM port is claimed by the utility program.

The status text field displays connection status and the utility command information between WiSER2400 utility program and the radio unit.

Radio Status Panel

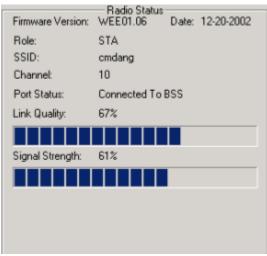The *Radio Status* Panel has only one mode, STA mode, shown in figure 3.

Figure 3. Radio Status Panels (AP: left; Station: right)

In general, the Radio Status Panel displays the firmware version, firmware release date, role, and communication channel used by the radio. The panel displays additional radio signal information such as the Port Status, Link Quality, and Signal strength.

Configuration Panel

This panel contains the following fields: SSID, Network Type, Baud rate, Channel, Max Bytes/Pkt, End Frame Byte of this unit. MAC addresses, IP addresses and UDP ports of this unit and the destination unit are also in this panel. To retrieve the settings, click on **Refresh** button on the main panel.
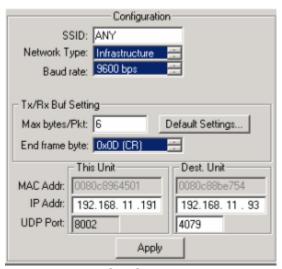

Figure 4. Configuration Panel

In addition, there are two buttons on this panel. The "Default Setting…" button is to set the Max Bytes/Pkt and End Frame Byte to 6 bytes per packet and 0x0D (Carriage Return) respectively.

The "Apply" button on this panel is for sending the 'Config' command to the radio unit that sets its configuration with above fields.

Followings are the detail descriptions of the fields:

SSID: The SSID that this radio would connect to. 32 characters maximum. An empty entry is acceptable but note that the radio would interpret it as 'ANY' which is a special SSID. A station with this special SSID would try to join a wireless network regardless of its SSID.

Network Type: this is the 802.11b mode the radio unit is running on. It can be either"Ad hoc" or "Infrastructure". For WiSER2400.IP to connect with a normal AP, always select "Infrastructure" mode Please refer to IEEE 801.11 documentation for more information of the Network Type. Default value: Infrastructure.

Baud rate: user-configurable. This is the baud rate the radio unit will use to transmit and receive RS232 data. Supported values: 2400, 4800, 9600, 14400, 19200, 38400, 57600, and 115200 bps. Default value: 9600 bps.

Channel: this field is applied only when the radio unit functions in 'Ad hoc' mode. Therefore, it is hid when the radio unit functions in 'Infrastructure' mode. Supported values: 1 – 14 channels.

Max Bytes/Pkt: This value specifies the maximum number of bytes a UDP packet can contain. Range: 1 to 200. Default value: 6.

End Frame Byte: This value specifies a special character that signals the end of a command (or portion of data) and the command (or portion of data) should be sent to the destination unit right after the radio receives this special character. Range 0x00 to 0x1F. Default value: 0x0D = Carriage Return. Note that user can choose 'None' value which means he would not use any special character in any case.

MAC Addr (MAC address of this unit): the MAC address of this radio.

MAC Addr (MAC address of destination unit): the MAC address of the destination device. The radio unit learns the MAC address of the destination unit from ARP response packets sent from the device with associated IP address.

IP Addr (IP address of this unit): the IP address of this radio. Configurable.

IP Addr (IP address of destination unit): the configurable IP address of the device which this radio would communicate with.

UDP Port (of this unit): the port number that this radio uses to communicate. This port number is the source Port in UDP packets sent from this radio. Fixed value: 8002

UDP Port (of destination unit): the port number the destination device listens on to get the UDP packet. This port number should be the destination Port on UDP packets destined to this radio.

RS232 and WLAN Statistics Panel

The transmission statistics of the RS232 (COM port) and Wireless Local Area Network (WLAN) is shown in this panel. To retrieve the statistics, click **Refresh** button located at the bottom of the main window of the utility program. The following explains the statistics shown in the panel:

1. **RS232 Statistics**:
   a. COM Sent: This number is the total bytes that the Unit sends through the connected COM port.
   b. COM Received: This number is the total bytes that the Unit received through connected COM port. This value is the sum of the following values:
      i. Without error: Total bytes received without error.
      ii. Break Detect error: Total bytes received as break detect error.
      iii. Frames error: Total bytes received with frame error.
      iv. Overrun error: Total bytes received with overrun error.
   c. Frames Discard: This number is the total number of frames that were discarded while the firmware tried to en-queue them to WLAN queue (send to MAC). Lacking of memory is the main reason for a frame to be discarded.

2. **WLAN Statistics**:
   a. Transmitted Frames: This number is the total UniCastFrames and MultiCastFrames that the MAC successfully transmitted
   b. Transmitted Retried Frames: This number is the total SingleRetryFrames and MultiRetryFrames that the MAC transmitted.
   c. Transmitted Octets: This number is the total bytes that the MAC successfully transmitted (UnicastOctets and MulticastOctets)
   d. Received Frames: This number is the total UniCastFrames and MultiCastFrames that the MAC successfully received.
   e. Received Error Frames: This number is the total frames that the MAC received with the following errors: DiscardNoBuffer, DiscardsWrongSA, DiscardWepUndecryptable, and Frame-Check-Sequence Errors.
   f. Received Octets: This number is the total bytes that the MAC successfully received (UnicastOctets and MulticastOctets)

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<u>**Security Panel**</u>

This panel shown in Figure 5 enables users to configure security options for the WiSER2400 radios. WiSER2400 supports Wired Equivalent Privacy (WEP) encryption both 64bits and 128bits.The Security panel contains two sub-panels, *Encryption* sub-panel and *WEP Keys Creation* sub-panel.
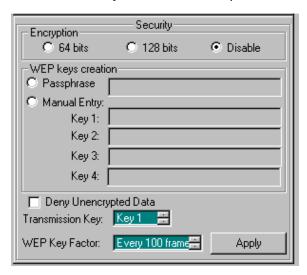

Figure 5 Security Panel

Encryption sub-panel

This sub-panel allows user to adjust the security level as needed. There are three radio buttons to select the encryption levels, and only one radio button can be selected at a time. The function of each radio button is described below:

  a. **Disable**: if checked, the WEP is turned off and WEP Keys Creation sub-panel becomes inactive.
  b. **64-bits**: if checked, the WEP is turned on using 64-bit encryption and WEP Keys Creation sub-panel becomes active.
  c. **128-bits**: if checked, the WEP is turned on using 128-bit encryption and WEP Keys Creation sub-panel becomes active.

Before applying the WEP 64 or 128-bit encryption to the radios, the user must complete the key settings in WEP Keys Creation sub-panel first.

WEP Keys Creation Sub-panel

This sub-panel allows user to generate users' own WEP encryption keys and can be made active only when either 64 bits or 128 bits radio button in the Encryption sub-panel is selected.

There are two methods to generate WEP encryption keys. One is to use auto key generation through the *Passphrase* field, and the other method is to manually input a set of keys in the *Manual Entry* fields.

To auto-generate WEP encryption keys, select the radio button next to the *Passphrase* label and then the users can enter up to any 64 characters in the *Passphrase* field. Click the **Apply** button to apply the encryption key setting. Notice that when this method is selected the Manual Entry fields are "grayed out" to disallow manual entries of WEP keys.

Figure 6 Create WEP Keys with Passphrase

To manually input keys, select the radio button next to the *Manual Entry* and then enter hexadecimal numbers to the fields next to Key 1 to Key 4. Click the **Apply** button to apply the encryption key setting. Notice that when this method is selected the *Passphrase* field is "grayed out" to disallow any input to the passphrase field.
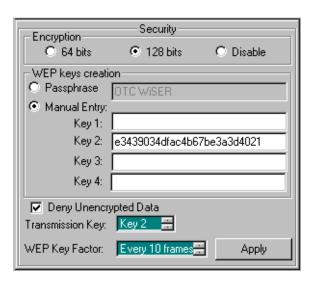

FIGURE 7 CREATE WEP KEYS WITH MANUAL ENTRIES

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The *Manual Entry Key 1/2/3/4* fields accept hexadecimal inputs as the encryption keys. If 64 bits encryption is enabled, each key field allows the user to enter up to 10 hexadecimal characters. If 128 bits encryption is enabled, each of the key field allows up to 26 hexadecimal characters.

The remaining fields in the Security Panel are described below.

   a. *Deny Unencrypted Data Frames*: if checked, the firmware will block unencrypted data frames from being received.
   b. *Transmission key*: This allows user to choose from key 1 to key 4 for transmission. The default key is set to Key 1.
   c. *WEP key factor*: this list box allows user to choose how many frames the Initialize Vector (IV) is reused. It contains four options: every frame, every 10 frames, every 50 frames, and every 100 frames. The default key factor is Every 100 frames.

When the **Apply** button is pressed, the program validates all entered data and prompts the user to re-enter the data if any of the input data is invalid. If all data is valid, the entered data will be applied to the radio unit. When the **Cancel** button is clicked, all entered data under S*ecurity Panel* is discarded.

Chapter 4 - UDP/IP Implementation

This section describes how the radio firmware composes RS232 data into UDP packets and sends them out, as well as how it receives the UDP packets and performs necessary checks. If all checks are passed, it retrieves the RS232 data from the packets, and sends the data out to RS232 cable.

When composing the UDP/IP packet header, the firmware only sets the important fields in the packet header, other less important fields are set with correct, fixed values and these values are unchanged during the operation time of the radio.

Upon receiving UDP/IP packets, the firmware only checks for validity of some important fields in the packet header. Others may be ignored.

Learning the destination MAC address from ARP packets.
After powered-up or its configuration is reset by the utility, the radio needs to learn the MAC address associated with the IP address of the destination device. It does this by composing an ARP packet and sends it out every second until it receives an ARP response from the intended device. This radio unit will not send and receive any thing until it receives the correct ARP response.

This part is very critical. So, if the radio seems not to communicate, please check the correctness of the "Dest unit's IP address" using the utility.

Outgoing UDP/IP packet:
a. IP Header:
  i.   Version: 4. (Fixed)

  ii.   Header length: 5 (Fixed)

  iii.   TOS: 8 (Fixed)

  iv.   Total length = IP header length + UDP header length + serial data length

  v.   ID = some timing value. Not important.

  vi.   Flags and fragment offset = 0x4000. (Don't fragment, Last fragment, fragment offset is 0)

  vii.   TTL: 128 (Fixed)

  viii. Protocol: UDP (Fixed)

  ix.   IP Header check sum = this IP header's checksum.

  x.   Source IP address = "IP Addr" in the "This Unit" portion in the configuration panel.

  xi.   Destination IP address = "IP Addr" in the "Dest. Unit" portion in the configuration panel.

  xii.   No option.

b. UDP header:
  i. Source Port number = "UDP Port" in the "This Unit" portion in the configuration panel.

  ii. Destination Port number = "UDP Port" in the "Dest. Unit" portion in the configuration panel.

  iii. UDP Length = UDP header length + data length. This data length would be =< "Max Bytes/Pkt" value.

  iv. The "Max Bytes/Pkt" field is in the "Configuration Panel." (See section II for detail).

  v. UDP Check sum = calculated over UDP header and serial data.

c. RS232 Data: this is the serial data received from serial port.

Incoming UDP/IP packet:
a. IP Header: checking on the following fields. Other fields that are not mentioned are not checked.
  i. Total length: must be greater than IP header length and UDP header length

  ii. Flags and Fragment offset: must be "Don't fragment" and "Last fragment"

  iii. Protocol: must be UDP.

  iv. IP Header check sum: must be correct

  v. Source IP address: must be equal "IP Addr" in the "Dest. Unit" portion in the configuration panel.

  vi. Destination IP address: must be equal "IP Addr" in the "This Unit" portion in the configuration panel.

b. UDP header: checking on the following fields. Other fields that are not mentioned are not checked.

  i. Source Port number: must be equal "UDP Port" in the "Dest. Unit" portion in the configuration panel.

  ii. Destination Port number: must be equal "UDP Port" in the "This Unit" in the configuration panel.

  iii. UDP Length = UDP header length + data length. The data length has to be =< 200.

  iv. UDP Check sum: ignored if 0. Otherwise, a checksum calculation is performed on UDP header and serial data.

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Chapter 5 - Troubleshooting

<u>Blank Pages Appear When Open the Utility Program</u>
It is possibly due to the unavailability of the COM port. Please pay attention to the *Connection and Overall Status* field next to the **Connect** button. Press the **Connect** button again to see if the status indicates "Connected." If not, check to see if you have another running program that access the same COM port.

<u>No Radio Link</u>
If the *Link Quality* indicator in the *Radio Status* panel shows 0%, check the following for possible causes:

- Make sure that the *Signal Strength* indicator under *Radio Status* panel is not zero. A minimum of 20% is recommended. If the "Signal Strength" is less than 20%, the distance between the WiSER2400 and the targeted AP may be too far. Decrease the distance between the radio pair to see if the radio link can be improved.

- Make sure that the encryption keys are entered correctly if WEP encryption is enabled.

- Make sure that there is no RF interference present in the radio network.

<u>No Data Transfer While the Radio Link is Good</u>
If the *Link Quality* indicator shows good link quality, but the host computer/equipment cannot properly exchange data:

- Make sure the RS232 cable are properly connected to the radio and computer/equipment.

- Make sure that the RS232 cable in use are not defective.

- Make sure that the COM port on the computer/equipment is available, not used by another active program/process.

Poor Link Quality

If the *Signal Strength* indicator is reasonably high (>20%) and the *Link Quality* is not zero, but the "Link Quality" stays in the Poor range, it could be due to one of the following reasons:

- Make sure that **radio interference** is not present in the radio network.

- Make sure that the radio is not surrounded by many strongly reflecting (metallic) surfaces. With multiple reflecting surfaces between the radio in question and the target radio, a severe **multi-path** problem may introduce high bit error rate despite a strong *Signal Strength*.

- Make sure that there is no severe **packet collision** caused by a "hidden node" problem. A "hidden node" problem is the situation where the RF signal from two or more Station radios cannot reach each other (but can reach the AP). In such situation, multiple Stations may attempt to transmit data packet to the AP at the same time and therefore cause packet collision. To solve this problem, re-arrange the Stations in question such that the RF signals are mutually sensible by all Stations. There is no guarantee that the packet collision can be entirely eliminated, but the severity can be reduced enough to see visible improvement of the link quality.

Radio Interference

You may be able to minimize RF interference by doing the following:

- Although WiSER2400, when properly configured, seeks a clear channel to use, it cannot avoid interference if too many 2.4GHz interference sources are present. A "clear" channel should be at least 20MHz, but preferably 30MHz, apart from any other channel in use. Find out other usages in this frequency band in the vicinity and try to coordinate the channel assignment with other users.

- Reseat the WiSER2400 radio to a location where the interference is minimized; in general, increasing the distance between the radio pair may cause radio interference.

- Avoid using 2.4GHz cordless phone in the vicinity of the radios

- Keep the computer with the WiSER2400 radio away from the microwave oven and large metal objects.

- Consult the dealer or an experienced radio technician for help and assistance.

Technical Support

If problems are still not solved, please contact our Technical Support to obtain further assistance.
Call: 1-800-770-6698 in USA
Call: 011-510-490-8288 outside of USA
E-mail:techsupport@otcwireless.com

Appendix A: Limited Warranty

WiSER2400 Hardware
The seller warrants to the end user ("Customer") that this hardware product will be free from defects in workmanship and materials, under normal use and service, for one (1) year from the date of purchase from the seller or its authorized reseller. The seller's sole obligation under this express warranty shall be, at the seller's option and expense, to repair the defective product or part, deliver to Customer an equivalent product or part to replace the defective item, or if neither of the two foregoing options is reasonably available, The seller may, in its sole discretion, refund to the Customer the purchase price paid for the defective product.

All products that are replaced will become the property of the seller. Replacement products may be new or reconditioned.

WiSER2400 Software
The seller warrants to Customer that each software program licensed from it, except as noted below, will perform in substantial conformance to its program specifications, for a period of one (1) year from the date of purchase from the seller or its authorized reseller. The seller warrants the media containing software against failure during the warranty period. No updates are provided. The seller's sole obligation under this express warranty shall be, at the seller's option and expense, to refund the purchase price paid by Customer for any defective software product, or to replace any defective media with software which substantially conforms to applicable seller published specifications. Customer assumes responsibility for the selection of the appropriate application programs and associated reference materials. The seller makes no warranty or representation that its software products will meet Customer's requirements or work in combination with any hardware or software applications products provided by third parties, that the operation of the software products will be uninterrupted or error free, or that all defects in the software products will be corrected. For any third party products listed in the seller software product documentation or specifications as being compatible, the seller will make reasonable efforts to provide compatibility, except where the non-compatibility is caused by a defect in the third party's product or from use of the software product not in accordance with the seller's published specifications or user manual.

Appendix B: Regulatory Compliance

FCC Part 15 Declaration of Conformity (DoC)
The equipment is confirmed to comply with the requirements of FCC Part 15 rules. The operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

FCC ID: MKZ0207232XG

FCC Rules and Regulations - Part 15
Warning: This device has been tested and found to comply with the limits for a Class B digital device pursuant to Part 15 of the Federal Communications Commissions Rules and Regulations. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try and correct the interference by one or more of the following measures:
. Relocate your WLAN equipped laptop computer.
. Increase the separation between the WLAN equipped laptop computer and other electronics.
. Connect the WLAN equipped laptop computer into an outlet on a circuit different from that of other electronics.
. Consult the dealer or an experienced radio/TV technician for help.

Caution: Changes or modifications not expressly approved by OTC Wireless could void the user's authority to operate the equipment.

FCC Radiation Exposure Statement
This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20cm between the radiator & your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

European Community (EC) Directives Conformity and Restrictions
This product is in conformity with the protection requirements of EC Council directives 89/336/EEC, 73/23/EEC, and 1999/5/EC on the approximation and harmonization of the laws of the Member States relating to electromagnetic compatibility, safety of electrical equipment designed for use within certain voltage limits and on radio equipment and telecommunications terminal equipment.

Compliance is indicated by the CE marking $C \epsilon \ \textcircled{\textsf{\scriptsize I}}$

This product satisfies the radio spectrum requirements of EN 300 328-1, the EMC requirements of EN 301 489-17 and the safety requirements of EN 60950.

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Glossary

Access Point An internetworking device that seamlessly connects wired and wireless networks. Access Points combined with a distributed system support the creation of multiple radio cells that enable roaming throughout a facility.

Ad Hoc Network A network composed solely of stations within mutual communication range of each other (no Access Point connected). The Ad Hoc network offers peer-to-peer connections between workstations, allowing communication between computers within range that have an 802.11
DSSS compatible PC card installed.

Channel A medium used to pass data units that can be used simultaneously in the same volume of space by other channels of the same physical layer, with an acceptably low frame error ratio due to the absence of mutual interference.

Encapsulated An Ethernet address mode that treats the entire Ethernet packet as a whole and places it inside an 802.11 frame along with a new header.

Ethernet The most widely used medium access method, which is defined by the IEEE 802.3 standard. Ethernet is normally a shared media LAN; i.e., all the devices on the network segment share the total bandwidth. Ethernet networks operate at 10Mbps/100Mbps using CSMA/CD to run over 10BaseT/100BaseT cables.

IEEE 802.11 The IEEE 802.xx is a set of specifications for LANs from the Institute of Electrical and Electronic Engineers (IEEE). Most wired networks conform to 802.3, the specification for CSMA/CD-based Ethernet networks or 802.5, the specification for token ring networks. 802.11 defines the standard for wireless LANs encompassing three incompatible (non-interoperable) technologies: Frequency Hopping Spread Spectrum (FHSS), Direct Sequence Spread Spectrum (DSSS), and Infrared. IEEE standards ensure interoperability between systems of the same type.

Infrastructure Network A wireless network centered about an Access Point. In this environment, the Access Point not only provides communication with the wired network but also mediates wireless network traffic in the immediate neighborhood.

IP *Internet Protocol*. The standard protocol within TCP/IP that defines the basic unit of information passed across an Internet connection by breaking down data messages into packets, routing and transporting the packets over network connections, then reassembling the packets at their destination. IP corresponds to the network layer in the ISO/OSI model.

LAN *Local Area Network*. A communication network that serves users within a defined geographical area. The benefits include the sharing of Internet access, files, and equipment, such as printers and storage devices. Special network cabling (10BaseT) is often used to connect the PCs together.

RS232 An EIA standard for serial data communication between equipment and computing devices.

SSID *Service Set ID*. A group name shared by every member of a wireless network.

Station The Station is the component that connects a host computer or device to the wireless medium. It may be referred to as the Wireless Network Adapter or the Wireless Network Interface Card.

WEP *Wired Equivalent Privacy*. The optional cryptographic confidentiality algorithm specified by 802.11 used to provide data confidentiality that is subjectively equivalent to the confidentiality of a wired LAN medium that does not employ cryptographic techniques to enhance privacy.

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